BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORD

RECORD 1988/25

A REVIEW, OVERVIEW, AND PREVIEW OF INDUSTRIAL MINERALS IN AUSTRALIA

BY

AERT DRIESSEN

RECORD 1988/25

A REVIEW, OVERVIEW, AND PREVIEW OF INDUSTRIAL MINERALS IN AUSTRALIA

BY

AERT DRIESSEN

A REVIEW, OVERVIEW, AND PREVIEW OF INDUSTRIAL MINERALS IN AUSTRALIA.

AERT DRIESSEN

Industrial minerals are different. This short paper, based on speaking notes used to deliver it at BMR's Petroleum and Minerals Review Conference (Canberra, 1988), alludes to some aspects that set the industrial minerals apart; it is also designed to familiarise readers with industrial minerals as a class and to provide something of a review, overview, and preview as promised by the title of the paper.

There is no universal definition for industrial minerals. Generally speaking they comprise the non-fuel and mostly non-metallic minerals that are used for their physical properties rather than as a material from which some element can be extracted. According to this definition the main industrial minerals are as shown in Fig.1, divided into 7 groups. Generally speaking the groups are based either on a geological affiliation (eg. mineral sands) or on an end-use affiliation (eg. construction materials, gemstones, and refractories). Bulk commodities and specialties represent a convenient split of what is left. As with most classifications some anomalies persist. The definition alludes to at least one reason why specifications are so much more important for industrial minerals than for metals and that is that the characteristics of industrial mineral ores (eg. colour, grainsize, reflectivity, density) carry through to the end-product whereas metallic ore characteristics finish up in a tailings pond. It also explains why the search for industrial mineral deposits should start in the market place rather than in the field, identifying and understanding the particular specifications required to meet a particular end-use, and then matching these specifications with deposit characteristics.

For some industrial mineral commodities, other things being equal, resources are not scarce in a physical sense. Leaving aside political land-use issues, resources of construction materials can virtually be created by creating a market. At the other extreme, gemstone resources are very scarce which is why they command such high prices. Between these two extremes the overriding consideration is that industrial mineral resources are not homogeneous; limestone is not limestone is not limestone, and sand is not sand is not sand. What that means is that sand for glass requires certain specifications, as does sand for foundry moulds, as does filtration sand, and as does construction sand, and none of them are the same. Such sands are more than different products; they are virtually separate commodities.

The perspective aspect of this paper is based very much on statistics. These are summarised in Tables 1 and 2. The raw statistical data on which they are based comprise quantities and values of mine production, exports, and imports for all mineral commodities, aggregated into three groups -- energy minerals, metals, and industrial minerals -- for the years 1960, 1970, 1980, and 1986. The statistical approach also raises questions. Although this paper focuses on specific time slices -- 1960, 1970, etc., it could be more appropriate to use rolling averages, that is, to use the average of 1969, 1970, and 1971 data instead of the specific 1970 value. Rolling averages smooth data and so tend to make them more representative.

Notwithstanding any shortcomings, the data are presented graphically in Figs 2 and 3. Both these barcharts are based on the same statistics but show the data in different ways -- Fig.2 groups the data by categories of minerals (energy, metals, and industrials) whereas Fig.3 groups the data by values of production, exports, and imports. All data are in constant 1986 dollars, all scales are the same, and all growth rates implicit in these barcharts are enumerated in Table 1 (see footnote (b)). In absolute terms the industrial minerals sector is small. In 1986 the ex-mine value of production of industrial minerals was $1856 million which accounted for only 9% of the value of production of all minerals; energy minerals accounted for 62% and metals accounted for 29%. But in fact the value of production of industrial minerals is very much understated because whereas the value of production of metals is taken at the concentrate stage, which includes such value-adding processes as ore-crushing, grinding, and separation by flotation, invariably carried out at mine sites, very few industrial minerals go through a concentrate stage. Indeed most industrial minerals are valued ex-mine at little more than their extraction cost, in addition to which such costs are generally low because most industrial minerals are exploited in surface rather than underground operations. A recent paper 'A world review of the industrial minerals industry' published in Mining Journal Vol 308 No 7919 (May 1987) referred to another paper by Bristow (1987) in which that author put the notion that one measure of a country's industrial maturity is marked by the point at which the value of production of industrial minerals first exceeds the value of production of metals. That happened in the UK in the last century and in the US early this century. In the UK the value of industrial minerals now exceeds the value of metals by a factor of 30, and in the US by a factor of 3. And Bristow was reported to have also asserted that that point was now also being reached in Australia. That would not seem to be borne out by these data but it could well be so if the comparison were made on the basis of end products -- that is, on the basis of comparing the aggregate value of all metals in refined form with the aggregate value of all industrial minerals in their end-product form eg. cement, pigment, fertilisers, refined and coated kaolins, sodium hydroxide, micronised calcium carbonate, all the various fillers, silica flour, magnesia or calcined magnesite, and perhaps even bricks and glass, as well as, of course, those commodities with inherent high values -- gemstones.

The 1960s were dominated by the metals; value of production, driven by export demand, increased by an average 13.9%/year over the whole decade. Industrial minerals ran second in the growth stakes, increasing in value by an average 9.3%/year -- also driven by export demand. The growth of industrial minerals ranked by groups in order of magnitude, was sustained by gems and semi- precious stones (27.1%/year, principally opal), mineral sands (15.7%/year), and fertiliser/chemical industry minerals, specifically salt, (10.7%/year).

The oil shock of 1973 and others that followed ensured that energy minerals dominated the 70s and 80s. Comparison of their production and export growth rates suggests that this was sustained by both export and domestic demand, perhaps indicating that Australia's endowment of energy mineral resources is finally being translated to a comparative advantage. That proposition is further supported by the fact that two energy-intensive silicon smelter projects have come to Australia -- one was commissioned in Tasmania last year (and is therefore not yet reflected in these statistics), and the other is firmly planned for Western Australia. Indeed when it comes to national strategies concerning mineral processing and the exploitation of comparative advantage, industrial minerals could well have more to offer than other minerals because as a general rule their processing technologies are more energy intensive as well as more sophisticated, which all translates to enhanced opportunities for adding value.

The industrial minerals sector, as an entity, has definitely come of age in the last 30 or so years and is presently poised to make even greater gains, again on the basis of export opportunities. As already mentioned, the ball started to roll in the 60s. Development of our export-oriented salt industry attracted various majors, noteably CRA which is now Australia's largest producer. That is not to say that industrial minerals were not previously honoured by the company of majors. BHP has had a long involvement with industrial minerals particularly refractories , manganese, silica, and salt. And so have CSR, WMC, and RGC had a long association with industrial minerals, the latter mainly by way of the acquisition of mineral sands producers. Indeed that episode probably heralded what I regard as a prolonged period of rationalisation, by mergers as well as acquisitions, which, while not as widespread and frenzied as in days gone by, persists to the present -- sustained by expanding, freer, and more competitive markets.

The process of rationalisation probably started in the mineral sands community back in the early 60s whence it spread to the refractories community, fertiliser manufacturers, construction materials producers, and the producers of specialty minerals. By way of example, the process of rationalisation has, for the time being, made Commercial Minerals Ltd, now in the stable of Australian Anglo American, the largest and most diverse producer of industrial minerals in Australia. The company markets more than a hundred products and operates some 20 quarries and mines for various mineral commodities as well as about 20 processing plants, laboratories, and warehouses.

By way of winding up the review and overview parts of this paper , the following pot-pouri of developments are representative and symbolic of the growth that the industrial minerals sector in Australia has experienced in more recent years; mineral sands are excluded because they are covered elsewhere.

- In the last two years Australian capacity of refined kaolin has increased about four-fold to about 200 000t/year; Comalco commissioned a 100 000t/year wet-process plant at Weipa in 1986 and Australian China Clays commisioned a 25 000t/year plant near Gulgong,NSW, in 1987. Another 25 000t/year capacity of refined kaolin is due to come on-stream this year at Greenbushes,WA.

- Greenbushes Ltd, which takes its name from the locality just mentioned, commenced spodumene (a lithium mineral) production some 4 years ago, at Greenbushes, and is now a world-ranked producer. The company is at present considering the feasibility of further processing to lithium carbonate to capture wider markets.

- Australia now has two dedicated calcium carbonate plants, one at Moss Vale, NSW, the other at Bathurst, NSW, each rated at about 100 000t/year capacity; about five years ago there were none.

- Australian Garnet Millers, a subsidiary of Target Petroleum, commenced garnet production in Western Australia only about five years ago and is now a world-ranked producer.

- Last year Pioneer Silicon Industries commissioned Australia's first silicon smelter at Snug, Tas., south of Hobart; Barrack Mines has a similar project in the pipeline which could come onstream next year, at Bunbury, WA.

- Australia's silica sand exports are experiencing strong growth.

- Argyle Diamond Mines JV is the world's largest producer of natural industrial diamonds and accounts for about 30% of world output. Another, smaller, producer will come onstream this year and others are likely to follow, further strengthening Australia's position.

Another positive feature that is not evident from these developments is the emergence of relatively small, technologically efficient, and entrepreneurial companies raising equity capittal in Australia, generally in the range $5M - $30M. Such enterprises should ensure that the momentum and vigour built up over the years is maintained.

Looking ahead, the industrial minerals industry is set to grow across all sectors. Indeed modest growth is already assured as these statistics (1986) catch up with various new projects already in production, noteably diamonds, mineral sands, silicon, and clay. Further growth is assured for the mineral sands for which various projects are either under construction or committed. These include additional synthetic rutile capacity, the processing of zircon to zirconia, and increased production and processsing of rare earth minerals. And in the slightly longer term there is CRA's recently-discovered mineral sands deposit at Horsham, Vic.

In the fertiliser sector two major companies, Queensland Phosphate Ltd (QPL), a subsidiary of WMC, and CSBP & Farmers are both working towards a phosphate mine in Australia -- QPL at Phosphate Hill, Qld, near Duchess, where infrastructure is already in place but presently on care-and-maintenance, and CSBP at Mount Weld, WA. QPL is planning to process its rock to phosphoric acid and high analysis fertilisers, using the sulphur content of Mount Isa Mines' smelter emissions, presently wasted to air. Taking the other sectors together, the mid-term future is likely to be boosted by:

- increased production of gem and industrial grade diamonds from new operations;

- increased production and exports of kaolin as existing and new capacity is more fully utilised;

- increased production of filler and coated grades of calcium carbonate as new capacity is brought on stream;

- increased production of silicon as new capacity is commissioned;

- increased production of sodium hydroxide as new capacity is built;

- increased processing of Australian jade and other gemstones as the recently-formed Gemstone Corporation achieves its aspirations;

But the most exciting project of all is Queensland Metals Corp's recently discovered magnesite deposit at Kunwarara, Qld, near Rockhampton. The discovery, or more accurately the recognition of a 500 Mt magnesite deposit virtually straddling the Bruce Highway, and covered by only 4 metres of overburden, is quite amazing. I emphasize recognition because magnesite occurences in the area are well documented. Perhaps all that underscores one theme of this paper, namely that an awareness of industrial minerals is important if you want to be in that business. You see what you want to see or, more accurately, you see what you can relate to or understand. Yet the people of Queensland Metals Corp. were not, to my knowledge, experienced in industrial minerals which makes their success all the more creditable. The company has farmed in Pancontinental Mining and Austrian-based Radex Heraklith and this Magnesia Joint Venture expects to complete its feasibility study by the middle of 1988 when a decision to proceed with construction will be made. The study envisages initial production of 150 000t/year sintered magnesia, 50 000t/year caustic calcined magnesia, and ultimately electrofused magnesia and magnesium metal. CSIRO is giving research assistance.

If this presentation sounds optimistic it is because I feel optimistic about the potential of industrial minerals. However, potential has to be actively exploited; it will not be realised by default. As I've already mentioned, I believe industrial minerals have more to offer than metals because their processing technologies tend to be more sophisticated and energy intensive. Following that line of thinking through leads me to the view that industrial mineral producers must kick the "import replacement" habit, which tends to persist, and fix their sights firmly on export markets. That is where the growth lies.

TABLE 1. MINERAL INDUSTRY COMPARATIVE SALIENT STATISTICS
1986 CONSTANT DOLLARS (MILL.)

	1960		1970		1980		1986	
INDUSTRIAL MINERALS								
Value of mine production (ex-mine)	469		1144		1592		1856	
Average annual rate of increase		9.3(a)		3.4(a)		2.6(a)		5.4(b)
Value of exports (f.o.b.)	100		432		616		576	
Av.annual rate of increase/(decrease)		15.8		3.6		(1.0)		7.0
Value of imports (f.o.b.)	187		354		561		476	
Av.annual rate of increase/(decrease)		6.6		4.7		(2.7)		3.7
METALS								
Value of mine production (ex-mine)	865		3175		5421		5674	
Average annual rate of increase		13.9		5.5		0.8		7.5
Value of exports (f.o.b.)	954		3873		7006		7223	
Average annual rate of increase		15.0		6.1		0.5		8.1
Value of import (f.o.b.)	173		135		193		187	
Av.annual rate of increase/(decrease)		(2.5)		3.6		(0.5)		0.3
ENERGY MINERALS								
Value of mine production (ex-mine)	820		1917		5031		12 369	
Average annual rate of increase		8.9		10.1		16.2		11.0
Value of exports (f.o.b.)	452		926		4269		7537	
Average annual rate of increase		7.4		16.5		9.9		11.4
Value of imports (f.o.b.)	1139		943		3896		1532	
Av.annual rate of increase/(decrease)		(1.9)		15.2		(14.4)		1.1
ALL MINERALS								
Value of mine production (ex-mine)	2154		6231		12 045		19 899	
Average annual rate of increase		11.2		6.8		8.7		8.9
Value of exports (f.o.b.)	1513		5231		11 889		15 337	
Average annual rate of increase		13.2		8.6		4.3		9.3
Value of imports (f.o.b.)	1499		1432		4648		2195	
Av.annual rate of increase/(decrease)		(0.5)		12.5		(11.8)		1.5
Gross Domestic Product								
(1985-86 prices, $billion)	87.0		142.1		199.5		238.9	
Average annual rate of increase		5.0		3.5		3.0		4.0

(a) Average annual growth rates in this column refer to one of the time spans 1960--1970, 1970--1980, or 1980--1986.

(b) Average annual growth rates in this column refer to the period 1960--1986.

TABLE 2. INDUSTRIAL MINERAL GROUPS - COMPARATIVE STATISTICS

	CURRENT $S (MILL)				1986 CONSTANT $S (MILL)(a)			
	1960	1970	1980	1986	1960	1970	1980	1986
CONSTRUCTION MATERIALS								
Value of mine production	53	144	472	923	296	629	765	923
exports	..	..	..	2	..	..	..	2
imports	..	..	4	12	2	2	6	12
MINERAL SANDS								
Value of mine production	10	55	161		56	240	261	268
exports	11	56	152		61	245	246	254
imports	-	-	-		-	-	-	-
REFRACTORIES								
Value of mine production	1	2	6	7	6	9	10	7
exports	..	..	1	1	..	..	1	1
imports	1	1	17	6	6	4	28	6
FERT/CHEM INDUSTRY MINS								
Value of mine production	4	14	52	123	22	61	84	123
exports	..	9	50	106	2	39	81	106
imports	15	42	192	292	84	183	311	292
BULK COMMODITIES								
Value of mine production	13	31	213	203	73	135	345	203
exports	4	15	117	138	22	66	190	138
imports	12	23	50	59	67	100	81	59
SPECIALTIES								
value of mine production	..	1	4	28	2	4	6	28
exports	..	2	6	14	3	9	10	14
imports	2	6	25	36	11	26	41	36
GEM/SEMI-PRECIOUS STONES								
Value of mine production	1	15	75	305	6	66	122	305
exports	2	16	53	62	11	70	86	62
imports	3	8	58	69	17	35	94	69
ALL INDUSTRIAL MINERALS(b)								
Value of mine production	84	262	982	1856	469	1144	1592	1856
exports	18	99	380	576	100	432	616	576
imports	16	81	346	476	187	354	561	476

.. Less than half the unit shown.
\- Nil

(a) Current $s converted to constant $s on basis of CPI data; index numbers are as follows:

1960 = 320
1970 = 409
1980 = 1102
1986 = 1786

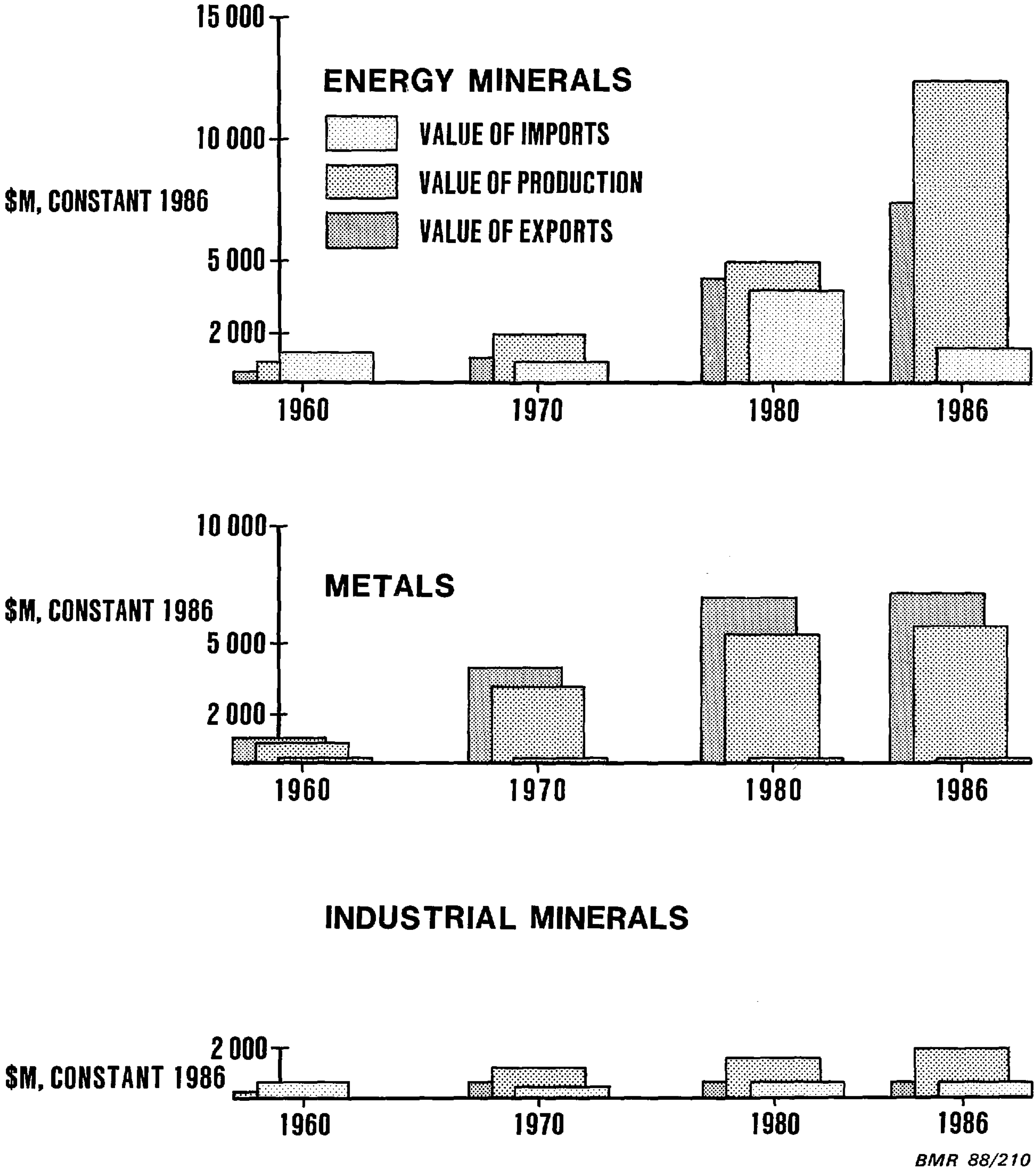
(b) Discrepancies in totals reflect rounding.

INDUSTRIAL MINERALS

CONSTR. MATERIALS	MINERAL SANDS	REFRACTORIES	FERT./CHEM. MINERALS	BULK COMMODITIES	SPECIALTIES	GEMS/SEMI-PREC. STONES
Brick clay/Shale	Ilmenite	Chromite	Arsenic	Asbestos	Barite	Diamond
Dimension St.	Monazite	Fireclay	Beryl	Clays	Diatomite	Opal
Crushed/Br. St.	Rutile	Dolomite	Boron	Gypsum	Felspar	Sapphire
Sand/Gravel	Zircon	Kyanite/Sillimanite	Bromine	Limestone	Graphite	Other
		Magnesite	Fluorspar	Manganese	Magnetite	
		Pyrophyllite	Lithium	Silica	Mica	
			Phosphate	Talc	Iron Oxide	
			Potash		Peat	
			Salt		Perlite	
			Sulphur			

Fig. 1

BMR 88/209



ENERGY MINERALS
VALUE OF IMPORTS
VALUE OF PRODUCTION
VALUE OF EXPORTS
$M, CONSTANT 1986
15 000
10 000
5 000
2 000
1960
1970
1980
1986
METALS
$M, CONSTANT 1986
10 000
5 000
2 000
1960
1970
1980
1986
INDUSTRIAL MINERALS
2 000
$M, CONSTANT 1986
1960
1970
1980
1986
BMR 88/210

Fig.2

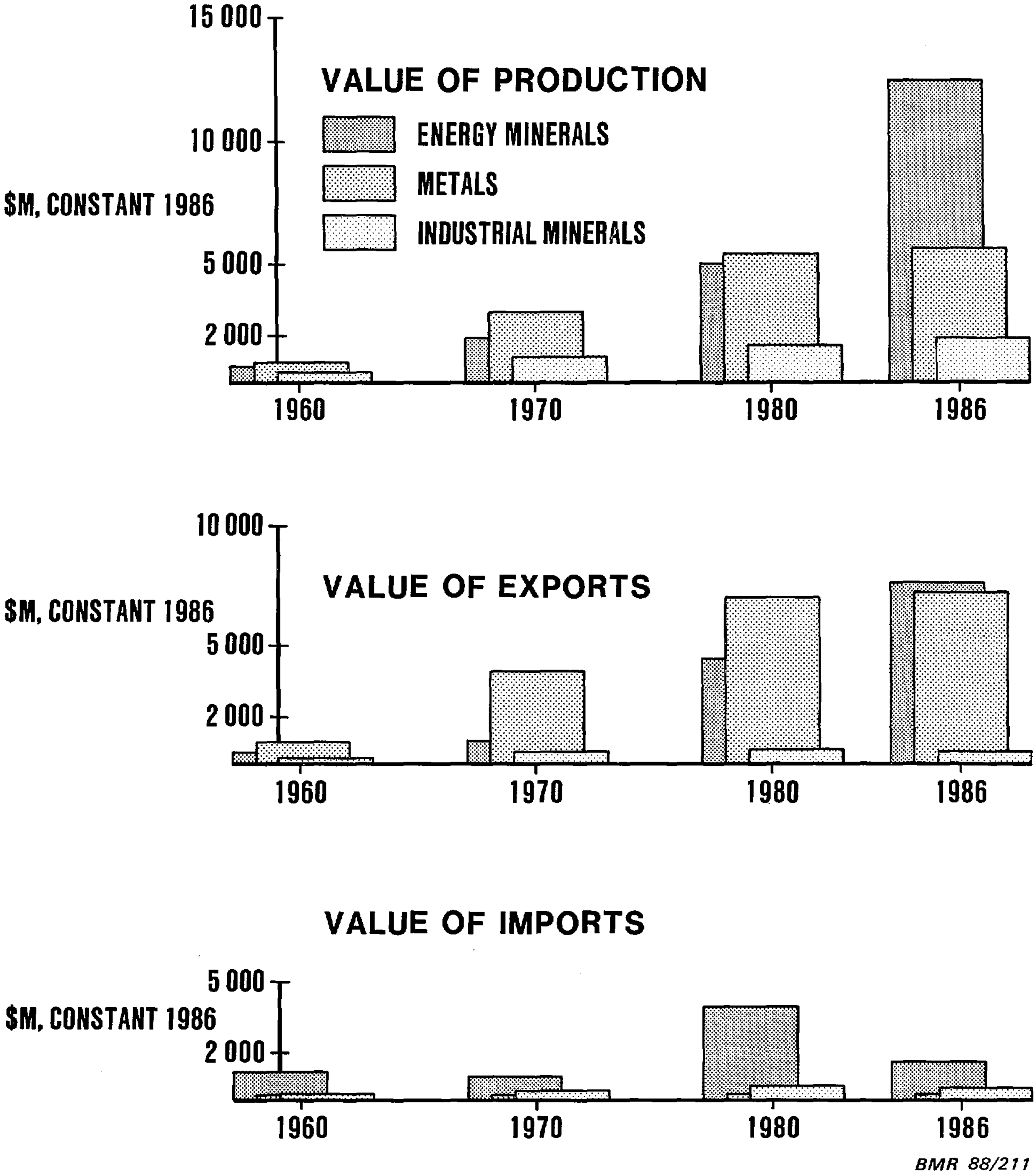

VALUE OF PRODUCTION
ENERGY MINERALS
METALS
INDUSTRIAL MINERALS
$M, CONSTANT 1986
15 000
10 000
5 000
2 000
1960
1970
1980
1986
VALUE OF EXPORTS
$M, CONSTANT 1986
10 000
5 000
2 000
1960
1970
1980
1986
VALUE OF IMPORTS
$M, CONSTANT 1986
5 000
2 000
1960
1970
1980
1986
BMR 88/211

Fig.3